774

Help Yourself to Science

by
N. A. WATTS

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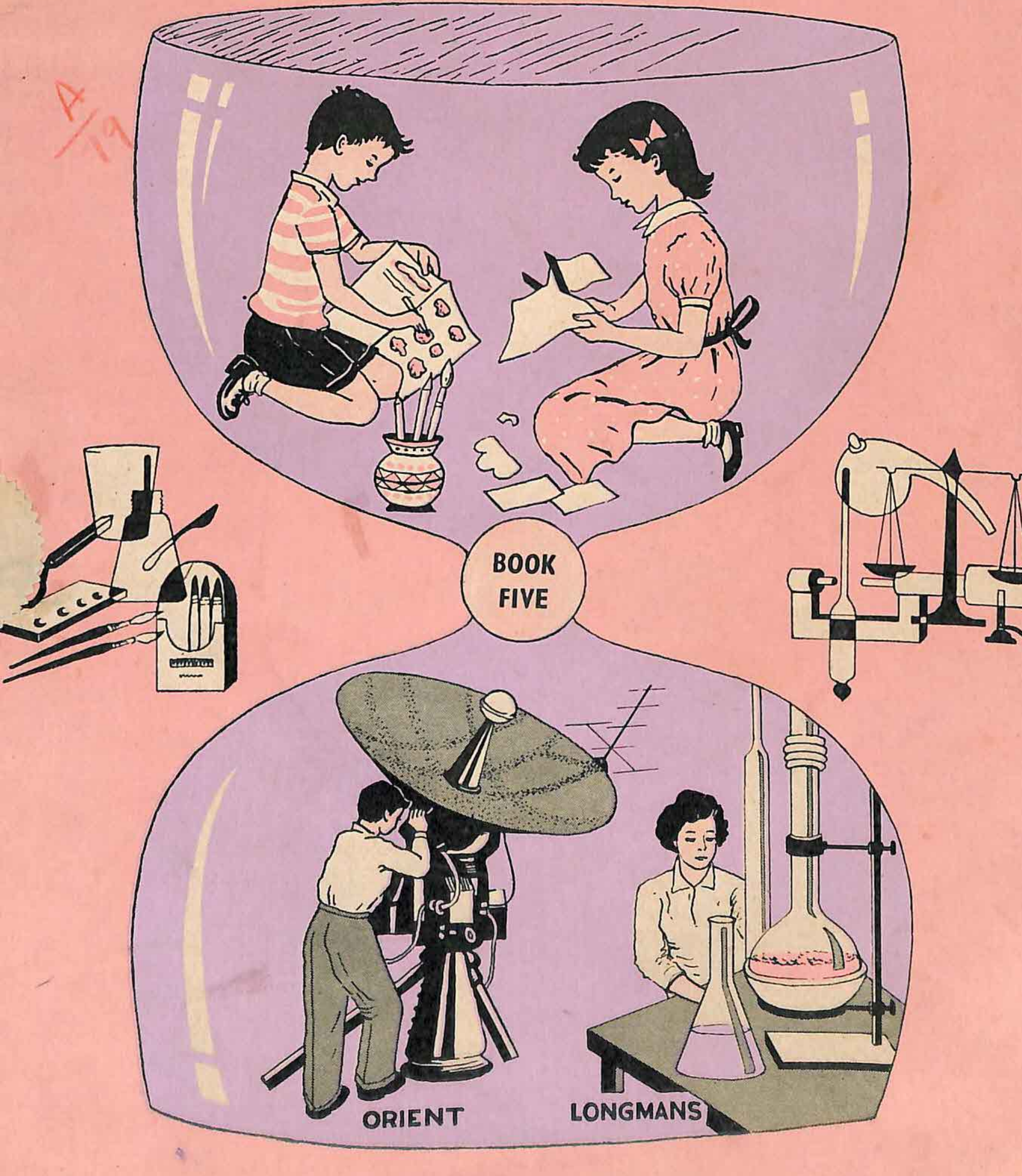

BOOK
FIVE

ORIENT LONGMANS

474

HELP YOURSELF TO SCIENCE

BOOK FIVE

A WORKBOOK TO ACCOMPANY

Adventures in Tropical Science, Book V

By

N. A. WATTS, B.SC., B.T., A.B.T.I.

State Institute of Education

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PREFACE

The analysis, identification, measurement and evaluation of the abilities of pupils that underlie and condition achievement in Science constitute the peak-point of the use of self-tests in modern, enlightened teaching practice. The self-tests in HELP YOURSELF TO SCIENCE are an important device in the teacher's diagnostic equipment, for they have been specially designed to test the mental ability of the pupil, not only from the view-point of content mastery, but have also taken into account other learning products which include such aspects as thinking skills and desirable attitudes.

Teachers will find that these informal objective tests inject a surprisingly large degree of accuracy into their methods of diagnosis, measurement and evaluation. Through the use of these adequately valid and reliable measuring devices, teachers will obtain precise, instructional information concerning the abilities and limitations of their pupils, of individual pupil differences in capacity and achievement and the status of achievement of the class as a whole.

The Workbooks will keep the pupil informed of his progress and this will inevitably serve as further incentive to greater effort. The tests will aid the pupil to check and marshal his grasp of the text and give him practice in the skills of collecting data, solving problems, applying his understanding to everyday situations and in this way, further reinforce his command of the subject.

These tests, chiefly because of their definiteness and objectivity, will also reveal to the teacher the extent of efficiency of certain special methods of instruction he has employed, while special types of emphasis he has used will be brought into sharp focus from a critical analysis and interpretation of the test-results. The results will also give the teacher evidence of pupil's progress towards specific goals of achievement: their ability to express their knowledge, the extent of their understanding of the science vocabulary used in the text, their mastery of facts, their growth in scientific attitudes, interests and appreciations and their proficiency in using their freshly acquired skills to identify, attack and solve problems. Furthermore, the results will provide the teacher with a basis for the objective grade placement of pupils.

HELP YOURSELF TO SCIENCE is purposely designed to ensure maximum activity on the part of the pupil. The learning experiences in the series have been styled and organised to involve the pupil in the process of learning about science, for it is such involvement in a meaningful learning experience which is directed towards the accepted objectives of science teaching, that will further vitalise his study of the texts and serve to develop, clarify and enrich his science understandings. These thought-provoking, study-helps are planned to raise the pupil out of the mire of conventional memorisation of factual material and the traditional tendency to cast all instruction into the mould of mere assimilation of subject matter; they aim at providing guidance to first-hand experiences which offer the pupil abundant opportunities to effectively translate into action his newly acquired knowledge in the world outside the classroom. Accordingly, specific directions are given for independent and group investigation and experimentation which focus on the major concepts and principles presented in the texts, so that, the pupil may experience the thrill of active participation as he explores his environment to collect the evidence he requires to facilitate his learning of the subject.

Properly exploited by the teacher the suggested experiences in each Workbook may well open new avenues of interest and satisfaction to the pupil besides amplifying and extending the corresponding text which it accompanies, thereby contributing to overall understanding and fulfilling the triple function for which it has been designed — to serve as a testing, a learning and a teaching aid.

Each Workbook contains tests which are constructed parallel to the chapters in the text-book it accompanies, so that the pupil's mastery of each chapter is facilitated. At the end of the Workbook are tests which require the integration of the knowledge gained in the preceding chapters in order to be answered correctly.

The sheets in the Workbook may be distributed separately in schools where a loose-leaf file is in use for the subject, or the Workbook can be used intact. In either case, the corrected exercises should be readily available as a reference for study and review.

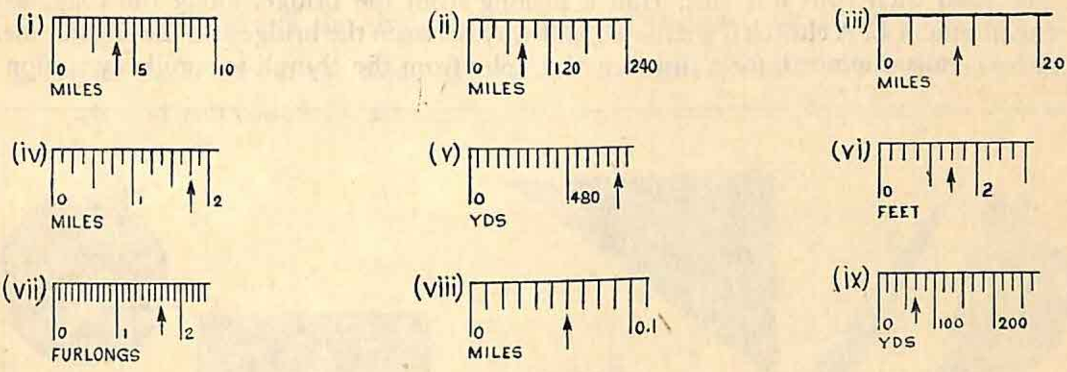
N. A. WATTS

NAME ____________________ CLASS ____________ DATE ____________

1

The Measurement of Length

1. Study the following scales:



a. State the size of each sub-division on each scale against its number.

i. ________ **ii.** ________ **iii.** ________

iv. ________ **v.** ________ **vi.** ________

vii. ________ **viii.** ________ **ix.** ________

b. Write the number of the scale you would use to make a map in your exercise book of:

i. Your bedroom ________ **ii.** Your town ________ **iii.** Your country ________

c. Read the point indicated by the arrow on each scale and write it, with its unit, against its number.

i. ________ **ii.** ________ **iii.** ________

iv. ________ **v.** ________ **vi.** ________

vii. ________ **viii.** ________ **ix.** ________

2. Solve these problems.

a. Express 7·4809 Km. in:

i. Centimetres ___ **ii.** Decimetres ___ **iii.** Decametres ___ **iv.** Millimetres ___ **v.** Metres ___

b. A stick of wood is 1 yd. long. When measured in centimetres it is found to be 91·5 cm. in length. Calculate to the second place of decimals:

i. The number of inches in one centimetre. ________

ii. The number of centimetres in one inch. ________

c. Find the length of a cane required to make a hoop one metre in diameter. ________

d. The radius of a metal sphere is 2·4 cm. What is its circumference in metres?

e. How many yards does the tip of the second hand of a clock travel in one hour if the hand is 21 in. long, from the centre to the circumference?

3. a. Construct a plan given the following information. State the scale you use.

A road runs due south for 60 yd. from a school *S* to a bridge *B*. There are four telegraph poles 45 ft. apart along the road, the first one being 30 ft. from the school. The road then runs due east. Half a furlong from the bridge, along the road, is an encampment *E*. A church *C* is situated half-way between the bridge and the encampment. A road runs due north for a distance of 4 poles from the church to a railway station *R*.

b. Answer the following questions.

- **i.** How many yards is the church from the school by way of the road?
- **ii.** How many yards is the encampment from the fourth telegraph pole by way of the road?
- **iii.** What is the shortest distance in yards from the second telegraph pole to the encampment?
- **iv.** How many feet is the shortest distance from the second telegraph pole to the church?
- **v.** What is the shortest distance in poles from the bridge to the railway station?

NAME____ CLASS________________ DATE________________

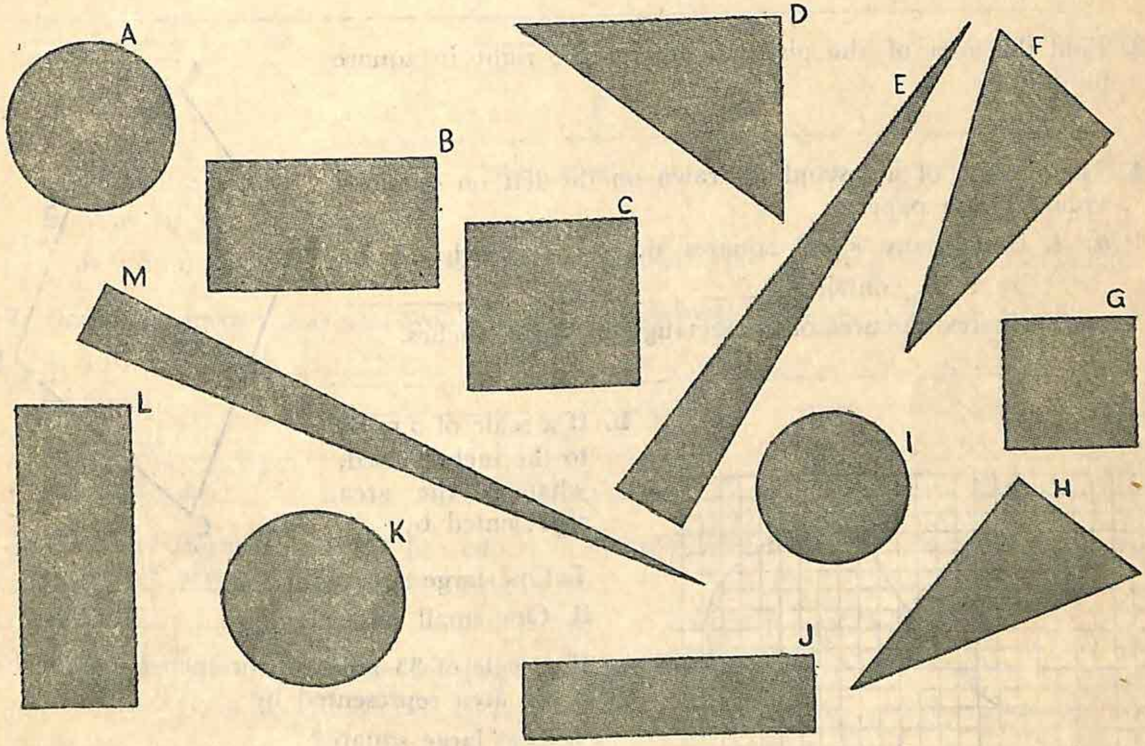
2

The Measurement of Area

1. Study the figures on this page. Three of them are equal in area.

a. Write the letters of the three figures which you think are equal in area.__________

b. Write the letters of the three figures that are equal in area after you have measured each and calculated its area.____



2. Solve these problems.

a. Measure and calculate the area of the front cover of this book. Express your answer in square millimetres.____

b. One inch equals twenty-five millimetres. How many square millimetres are equal to one square inch?____

c. What is the area of a label of length 16 cm. and breadth 13 mm.? Express your answer in square millimetres.____

d. A stamp has an area of 2·86 sq.cm. and a length of 2·2 cm. What is its breadth in millimetres?________

e. What is the area of one face of a fifty nP. coin in square millimetres?________

f. What is the area of a semi-circle of diameter 8 cm.?________

g. A circle of diameter 10 cm. is cut out of a sheet of cardboard 11 cm. square. What is the area of the cardboard remaining?________

h. What is the area of the ring between two concentric circles of radii 2 cm. and 4 cm.?

____

i. What is the area of the face of a circular clock whose circumference is 31·4 cm.?

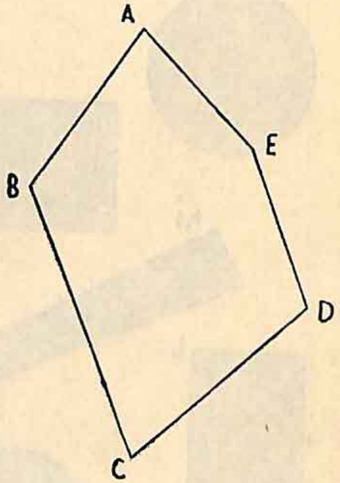
____

j. What is the length of cane you would require to make a hoop of area 28·26 sq.cm.?

____

3. Find the area of the given figure on the right in square millimetres.

____

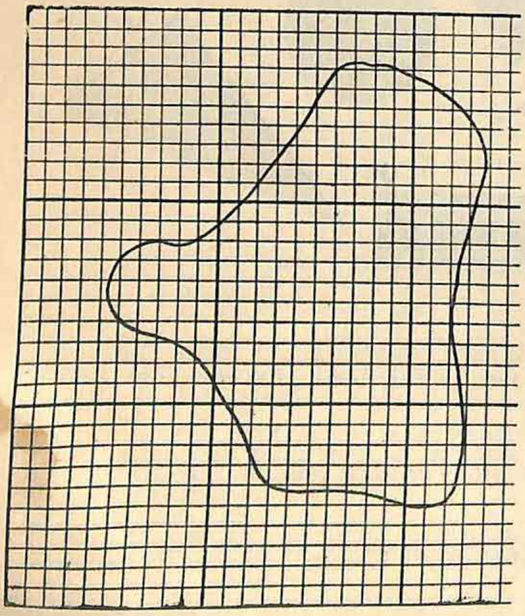


4. The outline of an island is drawn on the left on one-inch square graph paper.

a. i. How many small squares does a rectangle ·8 in. by ·5 in. contain?________

ii. Express the area of the rectangle in square inches.

____



b. If a scale of 5 miles to the inch is used, what is the area represented by

i. One large square?________

ii. One small square?________

c. If a scale of 35 miles to the inch is used, what is the area represented by

i. One large square?________

ii. One small square?________

d. Find the area of the island, by the method of counting squares, using a scale of 10 miles to an inch.________

e. Draw a right-angled triangle of height ·4 in. and base ·6 in. on the graph paper. What is the area by

i. Calculation?________

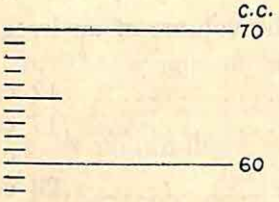
ii. The method of counting squares?________

NAME________________________________ CLASS____________ DATE____________

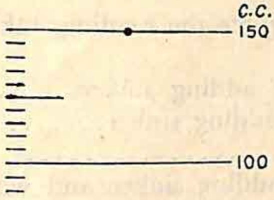
3

The Measurement of Volume

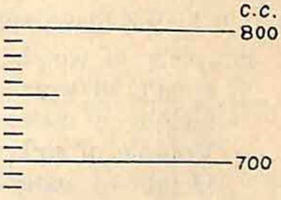
1. a. Fill in the blank space beneath each diagram.



A



B



C

1 sub-div. = ____ c.c. 1 sub-div = ____ c.c. 1 sub-div. = ____ c.c.

b. What is the equivalent of

i. 1·5 sub-divisions in *A*? ____ **ii.** 2·5 sub-divisions in *B*? ____ **iii.** 3 sub-divisions in *C*? ____

2. Name the instruments you would use to measure the following volumes of a liquid.

a. 15·7 c.c.________________________

b. 20 c.c.________________________

c. 1 litre.________________________

d. 142·8 c.c.________________________

3. State five steps, in order of procedure, if you were asked to find how many cubic centimetres of material there were in a stone.

i.________________________

ii.________________________

iii.________________________

iv.________________________

v.________________________

4. Differentiate between each of the following pairs.

a. A plane figure and a solid figure.

____

____

____

____

b. A liquid and a solid.

c. Volume and capacity.

5. Fill in the blank spaces to complete the readings taken to find the volume of an irregular piece of wood.

Height of water-level before adding sinker	12 c.c.
Height of water-level after adding sinker	17 c.c.
Volume of sinker	c.c.
Height of water-level after adding sinker and wood	28 c.c.
Volume of sinker and wood	c.c.
Volume of wood	c.c.

6. Solve these problems.

a. Find the volume of a match-box in cubic centimetres. Mention the brand of the match-box you measure.______

b. What is the volume of a cube whose edge measures 2·5 cm.? Express your answer in
i. Cubic millimetres______ **ii.** Cubic centimetres______ **iii.** Cubic decimetres______

c. If a tank measures 4 dm. by 25 cm. by 200 mm., how many litres of water will it hold?

d. How many times could a 250 c.c. flask be filled with liquid from a tank 500 cm. long, ·5 m. broad and 1 dm. deep?______

e. What is the height in mm. of a rectangular box if its volume is 8,400 c.c., its length is 80 cm. and its breadth is 7 dm.?______

f. A cylindrical well having an internal diameter of $2\frac{3}{8}$ yd. contains 12,460 gallons of water. Find the depth of the water in the well to the nearest foot. (1 cu.ft.=6·25 gall.)______

g. By how many centimetres does the level of water in a burette fall when 20 c.c. of water is drawn out? The radius of the cross-section of the burette is ·8 cm.______

h. How many cubic feet of gas will be contained in a balloon 6 ft. in diameter?______

i. If the level of water in a measuring cylinder stands at 52 c.c., what will the reading be when a marble of radius 3 cm. is put into it?______

j. A hemispherical bowl having an internal diameter of 30 cm. is half full of water. Find the volume of water in the bowl.______

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4

The Unseen Force that Pulls Everything down

1. What is meant by:

a. The force of gravity?

____

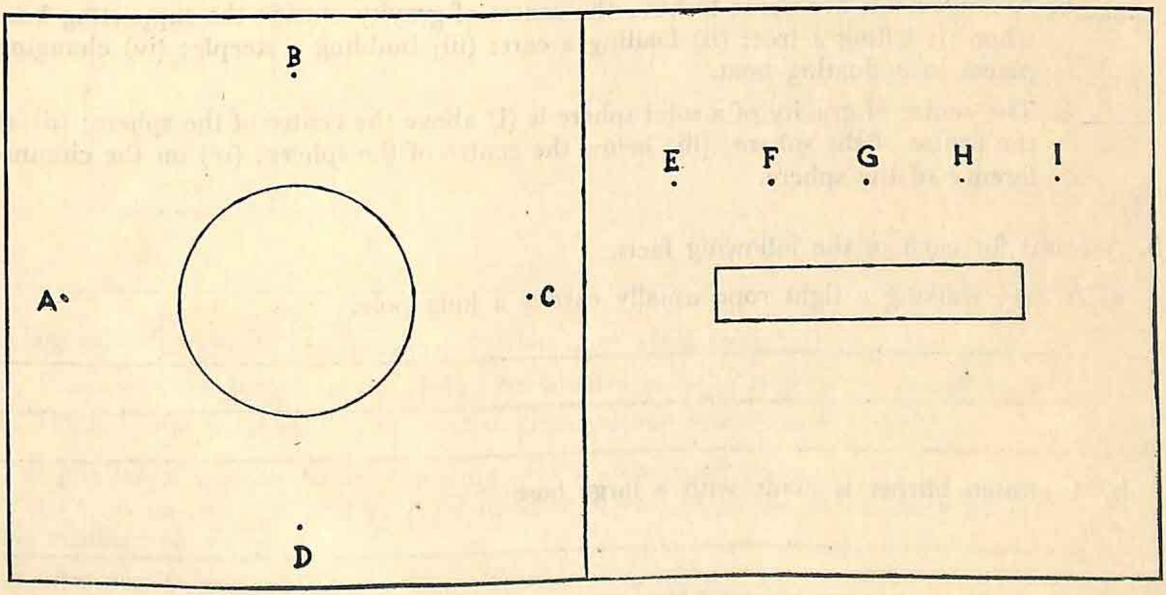
b. The weight of an object?

____

c. A plumb-line?

____

2. a. In the diagram on the left *A*, *B*, *C* and *D* represent the points of suspension of four separate plumb-lines and the circle represents the earth. Draw each plumb-line on the diagram, showing how it would hang.



b. In the diagram on the right, the shape of the earth is imagined to be like that of a cake. *E*, *F*, *G*, *H* and *I* represent the points of suspension of five separate plumb-lines. Draw each plumb-line on the diagram showing how it would hang.

3. Answer these questions.

a. Why is it that all objects tend to fall towards the earth and not away from it?

____

b. Why do people on opposite sides of the earth stand with their heads pointing away from each other?

c. Why is a brick heavier than an eraser?

d. How will you find out whether one object is heavier than another, without using a balance?

e. Why do we use the expression, 'centre of gravity' of an object?

4. Select the number of the item that best completes the statement and write it in the blank space on the left of each statement.

_____**a.** When an object tends to return to its original position after a slight push to one side it has (i) its centre of gravity at its apex; (ii) its centre of gravity at its centre; (iii) its centre of gravity at its base; (iv) its centre of gravity outside its substance.

_____**b.** Arrangements are made to have the centre of gravity outside the supporting base when (i) felling a tree; (ii) loading a cart; (iii) building a steeple; (iv) changing places in a floating boat.

_____**c.** The centre of gravity of a solid sphere is (i) above the centre of the sphere; (ii) at the centre of the sphere; (iii) below the centre of the sphere; (iv) on the circumference of the sphere.

5. Account for each of the following facts.

a. A man walking a tight rope usually carries a long pole.

b. A bunsen burner is made with a large base.

c. It is almost impossible to balance a pencil on its point.

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d. When a marksman fires in the standing position he keeps his legs well apart.

____

____

____

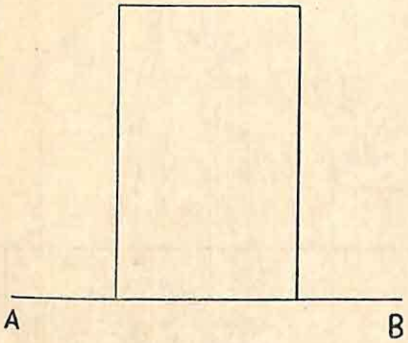
e. The eggs of most birds are narrower at one end than at the other.

____

____

____

6. Show by means of a diagram that the brick represented by a sectional diagram below, will fall over when the table *AB* is tilted through an angle of 31°.



7. A spring of length 20 cm. becomes 25 cm. long when stretched by a load of 5 gm.

a. What will the length of the spring be when a load of 10 gm. is applied to it?______

b. What is the mass of an object that produces an extension of 8 cm.?__________

8. The pointer of a spring balance moving over a metre scale points to 17½ cm. when a load of 5 gm. is on the pan, and to 22½ cm. when a load of 15 gm. is on the pan. What will the reading be when:

i. The pan is empty?______________________________

ii. There is a load of 30 gm. on the pan?______________________

9. If a tall vase is struck, under what conditions will it:

a. Remain standing?

____

b. Fall?

____

10. Find, by drawing diagrams, in the space marked *A*:

- **a.** How far the centre of gravity of a three-centimetre cube lies from one corner.________
- **b.** The angle of tilt that must be reached before the cube falls over.________________

11. **a.** Draw a diagram in the space marked *B*, to show the position of the centre of gravity of a rectangular card.

- **b.** Draw four lines through each angle of the rectangle which would be vertical if the card were suspended from each corner in turn.________________________

12. **a.** Draw a diagram, in the space marked *C*, to show the position of the centre of gravity of an isoceles triangular card.

- **b.** Draw three lines through the vertices which would be vertical if the card were suspended from each corner in turn.________________

13. Draw diagrams in the spaces below to show the approximate positions of the centre of gravity of:

- **a.** A spherical lamp suspended from a hook.
- **b.** A cone.
- **c.** A tea-cup.

A

B

C

A

B

C

NAME____________________ CLASS__________ DATE__________

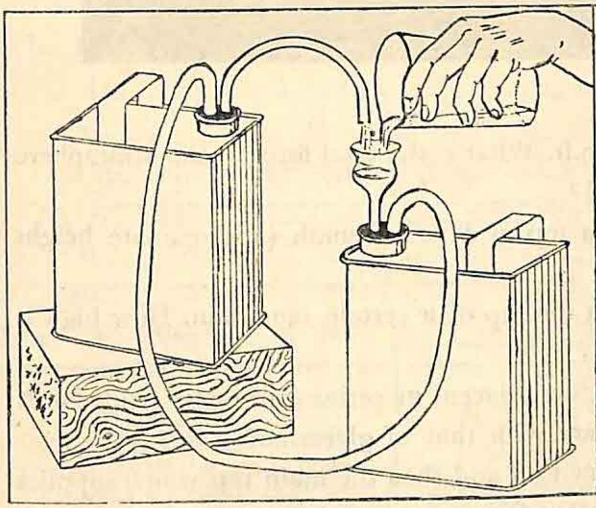
5

The Unseen Force that Presses on Everything

1. What is the normal reading of a mercury barometer in your neighbourhood?________

2. Study the apparatus in the diagram. When a tumbler of water is poured into the thistle funnel, water is seen to flow from the bent tube into the thistle funnel. The flow continues for some minutes even after the pouring of water from the tumbler is discontinued.

Make a sectional drawing on the right showing the depths to which each tube is inserted, and the level of water in each can at the beginning of the experiment.



3. How would you expect the normal reading of a mercury barometer to be affected it it is taken:

i. Into a room in which a fire is burning?

____

ii. To the bottom of a mine?

____

iii. To the top of a skyscraper?

____

4. State the kind of weather usually accompanying:

a. A low pressure area.________________________________

b. A high pressure area.________________________________

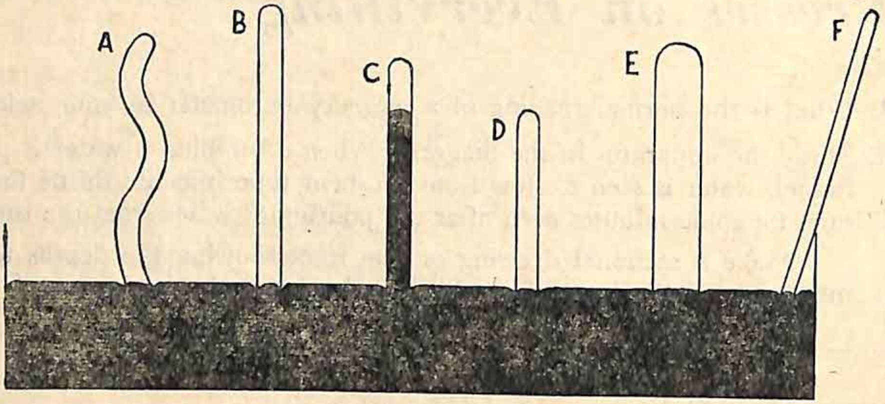
5. A boy constructed a simple mercury barometer in the school laboratory. On comparing the reading of his barometer with that of a standard barometer he found that his barometer read 74·5 cm., whereas the standard barometer read 75·6 cm. State three faults he may have committed in the construction of his barometer which could have caused the difference in readings.

i.____________

ii.____________

iii.____________

6. *A*, *B*, *C*, *D*, *E* and *F* are glass tubes. The level of mercury in tube *C* is shown. Indicate, by shading, the level of mercury in each of the other tubes.



7. Solve these problems.

a. The total surface of a man's body is 18 sq.ft. What is the total force of the atmosphere on the outside of his body at sea level?____________

b. What will a mercury barometer read on top of Mt. Parasnath (approximate height 5,000 ft.)?____________

c. The reading of a barometer is 17½ in. on the top of a certain mountain. How high is the mountain?____________

d. When a mercury barometer reads 30 in., an adjacent glycerine barometer reads 26 ft. How does the weight of mercury compare with that of glycerine?____________

e. The nozzle of a sprinkler hose is first turned off and then the main tap which supplies water to the hose is turned off. Explain what happens when the nozzle tap is opened.

____

____

8. Account for each of the following facts.

a. A weather balloon usually bursts when it rises to a certain height above the earth.

____

____

b. The reading of a barometer may vary at times.

____

____

c. Air presses in all directions.

____

____

NAME ____________________ CLASS __________ DATE __________

6

The Measurement of Temperature

1. State:

a. Five reasons why mercury is generally chosen as the liquid to be used in thermometers.

i. ____________________

ii. ____________________

iii. ____________________

iv. ____________________

v. ____________________

b. Two differences between a laboratory thermometer and a clinical thermometer.

i. ____________________

ii. ____________________

c. Three differences between a maximum thermometer and a minimum thermometer.

i. ____________________

ii. ____________________

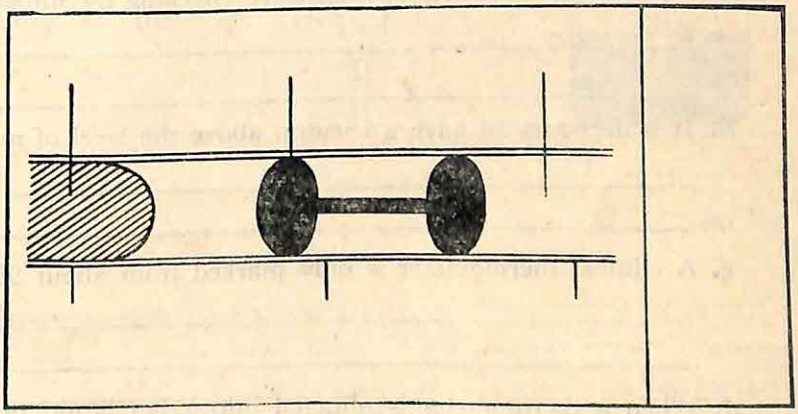
iii. ____________________

2. a. The diagram represents a portion of a ______ thermometer.

b. Label the parts indicated by the guide lines pointing upwards.

c. Mark an arrow on the diagram to show where the temperature is read off on the scale.

d. Write three approximate values on the scale that is marked below.



e. In the space at the right of the diagram, draw the instrument required to 'set' the thermometer.

3. How does atmospheric pressure help us in constructing a mercury thermometer?

____

____

____

4. Solve these problems.

a. Is a rise in temperature of 1°C. greater than a rise in temperature of 1°F.?

b. The level of mercury in a thermometer rises one-third the distance between the upper fixed point and the lower fixed point, when its bulb is immersed in warm water. What will the reading be if it was

i. A Centigrade thermometer?______________________________

ii. A Fahrenheit thermometer?______________________________

c. A faulty Centigrade thermometer registers 98·6° when its bulb is surrounded by steam from pure boiling water. What is the correct temperature when it registers 97·2°?

____

d. Convert 35°C. to °F.______________________________

e. Convert 77°F. to °C.______________________________

f. A faulty Centigrade thermometer registers 52° when a correct Fahrenheit thermometer registers 131°. What is the error in the Centigrade thermometer?__________

g. Express in °C a temperature which is 54°F. below the freezing point of water on the Fahrenheit scale.______________________________

h. Express in °F. a temperature which is 3·1°C. above the normal temperature of the human body on the Centigrade scale.______________________________

i. What temperature is the same on both the Centigrade and Fahrenheit scale?__________

5. Account for each of the following facts.

a. The barometer is usually read when checking the upper fixed point on a thermometer.

____

____

b. It is necessary to have a vacuum above the level of mercury in a thermometer.

____

____

c. A clinical thermometer is only marked from about 95°F. to 110°F.

____

____

d. When a thermometer is plunged into a hot liquid the mercury level is observed to fall slightly before it begins to rise.

____

____

e. Alcohol is chosen as the liquid to be used in the minimum thermometer.

____

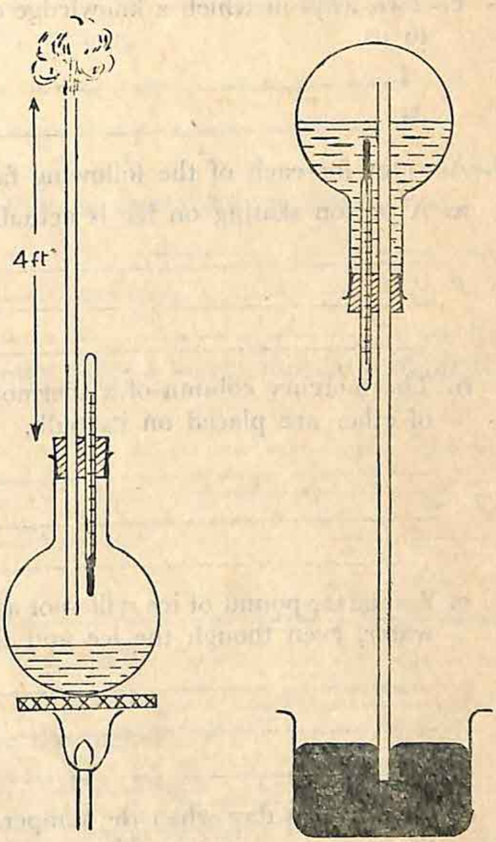
____

NAME ____________________ CLASS __________ DATE __________

7

Change of State

1. Some water is boiled in a round-bottom flask fitted with a two-hole stopper, a long glass tube, and a thermometer. After steam has issued from the glass tube for a short while, the source of heat is removed and the flask is inverted so that water does not run out of the tube, and the free end of the tube is inserted into a beaker of mercury.



a. Why does mercury rise up the glass tube?

b. To what height would the mercury rise if the apparatus were air-tight?

c. What difference would there be if water substituted mercury in the beaker?

d. Why does the water in the flask continue to boil even though the source of heat has been removed?

e. What temperature will be indicated on the thermometer? ____________________

f. What would you do to make more bubbles form in the water contained in the flask?

2. State:

a. Four factors which determine the rate of evaporation.

i. ______________ **ii.** ______________ **iii.** ______________ **iv.** ______________

b. Two factors which affect the boiling point of a liquid.

i. ____________________

ii. ____________________

c. Two ways in which a knowledge of the melting and boiling point of a liquid is of use to us.

i. ____________________

ii. ____________________

3. Account for each of the following facts.

a. A person skating on ice is actually skating on water.

b. The mercury column of a thermometer is observed to fall rapidly when a few drops of ether are placed on its bulb.

c. A quarter-pound of ice will cool a jug of lemonade more than a quarter-pound of ice-water, even though the ice and the ice-water are at the same temperature.

d. On a warm day when the temperature of the air and the temperature of a pool are the same, a swimmer shivers with cold when he emerges after a swim.

e. Once the water in a pan has begun to boil, the food cooking in the pan does not cook more quickly even when the heat is increased.

f. In cold, temperate countries, ponds become frozen in winter, whereas the sea at the same place is not frozen.

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g. A boy scout wets one of his fingers to determine the direction of the wind.

h. During the summer, plants are watered in the evening.

i. The boiling-point of water is affected when fruit or vegetables are boiled in it.

j. An egg placed in an open kettle of boiling water takes a longer time to cook at the top of a high mountain than at sea level.

k. You can see your breath on a cold day.

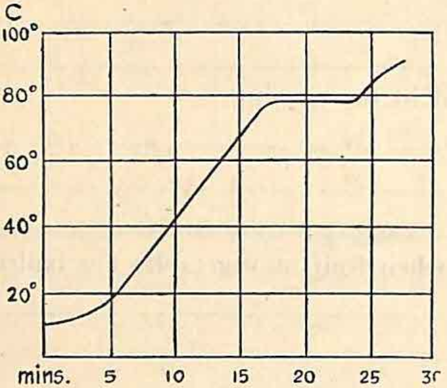
l. Ice water stays at 0°C. until all the ice in it has melted.

m. A burn caused by steam is more severe than a burn from hot water.

n. It is a good practice to put on a sweater or a coat after violent exercise.

o. We feel uncomfortable on warm, wet days.

4. a. Draw a diagram in the space on the right to show the apparatus required to determine the melting point of wax.



b. The graph shows the curve obtained during the determination of the melting point of wax. Study the graph and then answer the following questions.

i. What is the melting point of wax?______________________________

ii. When did the wax melt?______________________________

iii. Why did not the temperature continue to rise when melting began?

5. Mark **X** in the blank spaces on the left of the following to indicate that a Centigrade thermometer will register 100° when its bulb is placed

______**a.** In boiling tap water.
______**b.** In boiling milk.
______**c.** In the vapour above boiling milk.
______**d.** In boiling stew.
______**e.** In distilled water.
______**f.** In boiling salt water.
______**g.** In steam.
______**h.** In the vapour above boiling stew.

6. A thermometer registers −8°C. when its bulb is placed in a mixture of crushed ice and salt. How would you lower the temperature still further?

7. At what approximate temperature (in degrees Centigrade) would water boil at the top of Mount Everest, approximate height 29,000 ft.?______________________________

NAME ______ CLASS ______ DATE ______

8

What Everything is made of

1. Differentiate between each of the following pairs.

a. An element and a compound.

b. A physical and a chemical change.

2. Complete the following table.

Compound	*Elements of which the compound is composed*
Water	
Common salt	
Iron sulphide	

3. State:

a. Four reasons for regarding air as a mixture and not a compound.

i.

ii.

iii.

iv.

b. Three reasons for regarding the rusting of an iron bolt as a chemical change.

i.

ii.

iii. ____

____

c. Four reasons for regarding water as a compound and not a mixture.

i. ____

____

ii. ____

____

iii. ____

____

iv. ____

____

4. In the blank space on the left of each of the following:

a. Indicate its nature by writing **E** for element, **C** for compound, or **M** for mixture.

_____	**i.** Ice.	_____	**ii.** Brass.
_____	**iii.** Brine.	_____	**iv.** Carbon dioxide.
_____	**v.** Mercury.	_____	**vi.** Iodine.
_____	**vii.** Chalk.	_____	**viii.** Glass.
_____	**ix.** Soil.	_____	**x.** Steel.

b. Write the letter **P** against those items that may be classified as physical changes, or the letter **C** against those that may be classified as chemical changes.

_____ **i.** The evaporation of water.
_____ **ii.** The magnetisation of a strip of iron.
_____ **iii.** The digestion of a piece of meat.
_____ **iv.** The souring of milk.
_____ **v.** The softening of glass by heat.
_____ **vi.** The dissolving of salt.
_____ **vii.** The decaying of a plant.
_____ **viii.** The erosion of a rock.
_____ **ix.** The glowing of the filament in an electric lamp.

5. Although pure water consists of oxygen and hydrogen, fish cannot use the oxygen for respiration. Explain.

____

____

____

____

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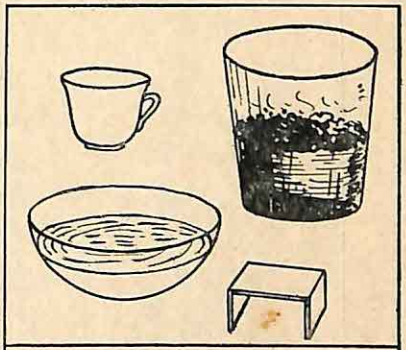
9

Solution and Crystallisation



1. a. How will you prepare a sample of distilled water if you were given a metal pan containing cold water, a large tumbler containing boiling ink, a bent strip of tin, and a small cup?

b. Draw a sectional diagram of the apparatus when fitted up and being used.

2. Underline:

a. The solutions in the following list: benzene, glycerine, lemonade, paraffin, petrol, rain-water, sea-water.

b. The crystalline substances in the following list: alum, baking soda, flour, starch, sugar, washing soda, talcum powder.

c. The substances which dissolve in methylated spirit: common salt, glycerine, gum arabic, iodine, linseed oil, machine oil, paraffin wax, resin, shellac.

3. Pour some distilled water (available from any petrol station) into a bowl. Add a handful of soil to the water and mix thoroughly. Filter the mixture and heat the filtrate in a metal pan until all the water has evaporated.

a. What remains in the pan? ______

b. What fact does this experiment demonstrate?

c. Why was it necessary to use distilled water for this experiment instead of tap water?

d. What is the importance of the fact demonstrated by this experiment in the life of a plant?

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4. With a sample of muddy sea-water, what process(es) would you employ to (**a**) remove the mud; (**b**) obtain a specimen of common salt; (**c**) obtain chemically pure water?

a.

b.

c.

5. Draw a sectional diagram of the apparatus you would use for **4**(**c**). Label the diagram.

6. Nature is continually manufacturing pure and salt water. Explain.

7. How would you find out whether a cupful of a liquid given to you were a pure liquid or a solution?

8. Account for each of the following facts.

a. Water is an extremely useful liquid.

b. Deep wells are likely to have purer water in them than shallow wells.

c. Rings are seen on a saucer when a drop of tap water is allowed to evaporate on the surface of the saucer.

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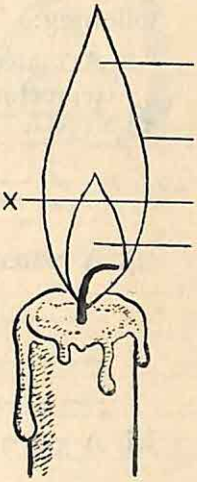
10

Combustion and Flame

1. a. A piece of paper is firmly stretched between the hands while facing a table. It is held for a moment in a candle flame at *XX′* and then removed quickly. On examination, its under-surface shows a charred ring with a large ring of soot inside it, and a greasy unburnt patch in the centre. What does this experiment tell us about the flame of a candle?



____

____

____

____

____

b. Identify the parts indicated by guide lines in the diagram.

c. Colour the different zones with their proper colour.

2. How would you prove to a friend:

a. That candle wax contains carbon?

____

____

b. That candle wax contains hydrogen?

____

____

c. That a gaseous compound is formed during the burning of a candle?

____

____

d. That an element contained in air is essential for the burning of a candle?

____

____

e. That liquid wax rises up the wick of a candle when it burns?

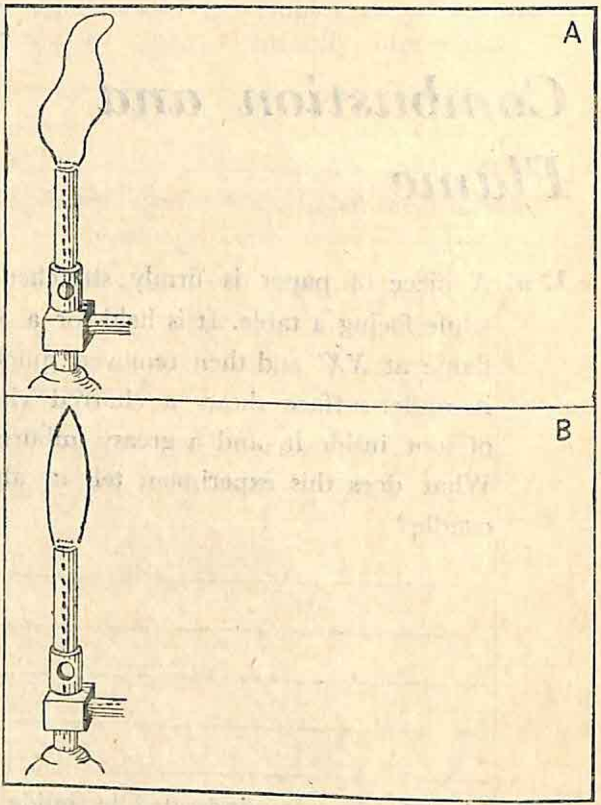
____

____

3. **a.** Indicate on the diagrams *A* and *B*, the different zones of a bunsen flame.

b. Label fully each completed diagram.

c. Colour the different zones with their correct colours.



4. State:

a. One use man makes of each of the following:

i. A material with a low kindling temperature.

ii. A material which does not burn.

iii. A gas supporting combustion.

b. Two reasons why a house-holder dislikes a smoky fire.

i.

ii.

c. The difference between an inflammable gas and a gas which is a supporter of combustion.

5. Define:

a. Combustion.

b. Ignition temperature.

c. Flame.

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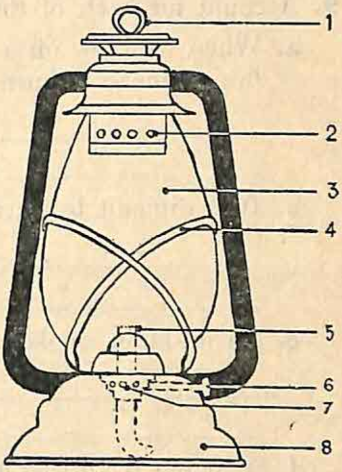
6. a. Identify the parts indicated by guide lines in this sectional drawing of a hurricane lamp. State the function of each part.



1.____________________ *Function:*____________________

2.____________________ *Function:*____________________

3.____________________ *Function:*____________________

4.____________________ *Function:*____________________

5.____________________ *Function:*____________________

6.____________________ *Function:*____________________

7.____________________ *Function:*____________________

8.____________________ *Function:*____________________

b. Draw arrows on the drawing of the lamp to show the paths taken by air currents.

c. In the space on the left draw the flame of a hurricane lamp. Label the different zones of the flame.

7. What condition, essential for combustion, is removed when:

a. A can of burning grease is covered?

____

b. The valve controlling the supply of gas to a bunsen burner is closed?

____

c. Water is poured on a bonfire?

____

8. In the blank space on the left of the following, write the numbers 1-7 to indicate the order of kindling temperature from the one with the lowest to the one with the highest.

____**a.** Coal.____**b.** A match-head.____**c.** A mixture of equal parts of potassium chlorate and sugar.____**d.** Paper.____**e.** Sugar.____**f.** Sulphur.____**g.** Wood.

9. Account for each of the following facts.

a. When we blow on a burning match we put the flame out, yet we blow on a kitchen fire to make it burn well.

b. It is difficult to burn a book in a fire.

c. An oil-lamp smokes if its wick is turned up too high.

d. A match has to be struck against the side of a match-box in order to light it.

e. The air in cities is more impure than the air over villages.

f. A sound is heard when the air-hole of a bunsen burner is opened.

10. What would you do:

a. To prevent a coal fire from smoking?

b. To make a bunsen burner give a bright light?

c. To make a bunsen burner give off intense heat?

d. To put out a fire on a scrubland?

e. If the clothes of a person caught fire?

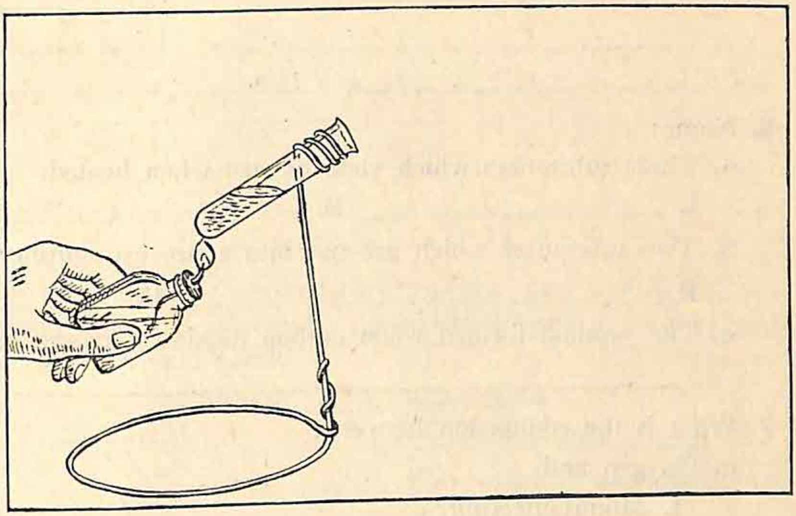
NAME CLASS DATE

11

Two Useful Gases— Oxygen & Carbon Dioxide

1. a. Complete the diagram to show how you would collect oxygen by heating hydrogen peroxide in a test-tube.

b. Label the completed diagram fully.



2. Can you make sugar catch fire? Use cigarette ash from an ash tray as a catalyst, and see what happens when you place a lighted match against the mixture. Write an account of your experiment.

3. a. What is "dry ice"?

b. What is "dry ice" used for?

c. State three advantages "dry ice" has over ordinary ice.

i.

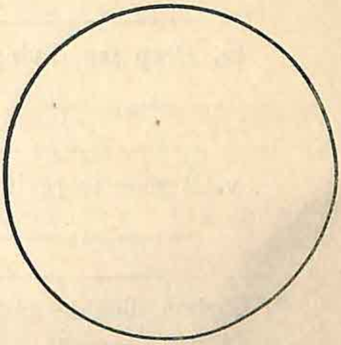
ii.

iii.

4. a. The composition of air is as follows:

Nitrogen	78·08%	Carbon dioxide	0·03%
Oxygen	20·95%	Helium, Neon, Krypton, Hydrogen, Xenon, Radon & Ozone	0·01%
Argon	0·93%		

Make a circle graph to illustrate this information.



b. What would happen if the atmosphere consisted solely of oxygen?

5. When oxygen is prepared:

  a. Why must the test-tube be held in a horizontal position?

  b. Why must we allow the first few bubbles to escape?

6. Name:

  a. Three substances which yield oxygen when heated.

  i.______ **ii.**______ **iii.**______

  b. Two substances which are put into a fire extinguisher to give carbon dioxide.

  i.______ **ii.**______

  c. The product formed when carbon dioxide is passed into water.

7. What is the connection between:

  a. Oxygen and

    i. Mountaineering?

    ii. Welding?

    iii. Artificial respiration?

    iv. Deep sea diving?

    v. Rescue work in mining accidents?

  b. Carbon dioxide and

    i. Ice cream?

ii. Lemonade?

iii. Fire?

iv. Starch manufacture?

v. Cakes?

8. Mark with an **O** those properties that are characteristic of oxygen, and with a **C** those that are characteristic of carbon dioxide. Mark **OC** against those properties that are characteristic of both oxygen and carbon dioxide.

________Colourless
________Heavier than an equal volume of air
________Non-inflammable
________Odourless
________Slightly soluble in water
________Supports combustion
________Faint smell
________Makes lime water milky
________Non-supporter of combustion
________Sharp taste
________Soluble in water
________Tasteless.

9. State:

a. One recognition test for oxygen.

b. One recognition test for carbon dioxide.

c. Two uses of the oxy-acetylene flame.

i. ________________________________

ii. ________________________________

d. Three ways in which carbon dioxide gets into the atmosphere.

i. ________________________________

ii. ________________________________

iii. ________________________________

e. Two ways by which carbon dioxide is removed from the atmosphere.

i. ________________________________

ii. ________________________________

10. Account for each of the following statements.

a. Although manganese dioxide yields neither oxygen when it is heated nor combines with potassium chlorate to produce oxygen, yet it is mixed with potassium chlorate in the test-tube in which oxygen is generated.

b. After the preparation and collection of oxygen, the delivery tube must be raised out of the water in the trough before the burner is extinguished.

c. A splinter burns more rapidly and fiercely in a jar of oxygen than in a jar of air.

d. Flowers and their foliage should be removed from a sick bed at night.

e. A burning candle is lowered into a well before it is deemed safe for a person to go down.

11. In the space below draw a sectional diagram of the apparatus used in the laboratory preparation of oxygen. Label the diagram.

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12

What All Living Things Can Do

1. Name:

a. Seven activities common to all living things.

i.__________ **ii.**__________

iii.__________ **iv.**__________

v.__________ **vi.**__________

vii.__________

b. Three external stimuli which affect the movements of plant parts.

i.__________ **ii.**__________ **iii.**__________

c. Five parts of our body which help us to suitably adjust ourselves to our surroundings.

i.__________ **ii.**__________ **iii.**__________

iv.__________ **v.**__________

2. What is meant by each of the following terms? Give three examples in each case.

a. Tendrils.

____

____

Examples of plants possessing tendrils: **i.**__________ **ii.**__________ **iii.**__________

b. Carnivorous animals.

____

Examples of carnivorous animals: **i.**__________ **ii.**__________ **iii.**__________

c. Herbivorous animals.

____

Examples of herbivorous animals: **i.**__________ **ii.**__________ **iii.**__________

d. Omnivorous animals.

____

Examples of omnivorous animals: **i.**__________ **ii.**__________ **iii.**__________

3. State:

a. Three instances from everyday life when we make responses for reasons of protection.

i.__________

ii.__________

iii.__________

b. Three differences in the modes of the lives of animals and plants.

i.

ii.

iii.

4. What is the relationship between plants, animals and minerals?

5. Differentiate between each of the following pairs.

a. The movement of a bicycle and that of an animal.

b. The growth of a crystal in a saturated solution of salt and that of a living being.

c. A stimulus and a response.

6. How would you prove to a friend that a pea-seed is a living thing?

7. Why do plants have no need to move from place to place?

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13

The Usefulness of Plants to Man

1. Group I is a list of plants. Group II is a list of the various products obtained from plants. Select the number(s) of the product(s) obtained from certain plants and write it (them) in the blank spaces on the left of the appropriate plant.

Group I

__________**a.** Cocoa

__________**b.** Flax

__________**c.** Indigo

__________**d.** Jute

__________**e.** Mahogany

Group II

1. Canvas. 2. Chocolate. 3. Dye. 4. Furniture. 5. Gunny bags. 6. Linen. 7. Linseed oil. 8. Thread. 9. Twine. 10. Writing paper.

2. Underline the names that are out of place.

a. Cereals: barley, bean, maize, millet.

b. Vegetables: beetroot, brinjal, cabbage, plum.

c. Fruit trees: cherry, guava, mango, sal.

d. Timber trees: ebony, opium, pine, teak.

e. Fungi: mould, mushroom, seaweed, yeast.

3. What are the characteristics of:

a. Fern plants?

____

____

____

b. Moss plants?

____

____

____

c. Thallus plants?

____

____

____

d. Seed-bearing plants?

____

____

____

4. Group I is a list of plants and Group II is a list of plant storage organs. In the blank space before the letter of each plant, write the number of the storage organ in which it stores its reserve food.

Group I

______ **a.** Beetroot. ______ **b.** Brinjal. ______ **c.** Cabbage. ______ **d.** Carrot.

______ **e.** Celery. ______ **f.** Ginger. ______ **g.** Gourd. ______ **h.** Lettuce.

______ **i.** Onion. ______ **j.** Potato. ______ **k.** Radish. ______ **l.** Tomato.

Group II

1. Fruit. 2. Leaf. 3. Root. 4. Underground stem.

5. Differentiate between algae and fungi.

____

6. In the space on the left draw a seaweed, in the centre draw a mould, and in the space on the right draw a moss plant.

7. How are the following plants useful to us?

a. Algae.

____

b. Bamboo.

____

c. Bracket fungi.

____

d. Moss plant.

____

e. Yeast.

____

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14

The Usefulness of Animals to Man

1. State the chief characteristic(s) of the following groups of animals.

a. Annelid worms.

b. Molluscs.

c. Arthropods.

d. Fishes.

e. Amphibians.

f. Reptiles.

g. Birds.

h. Mammals.

2. State two ways in which the earthworm helps the gardener.

i. ______________________

ii. ______________________

3. Place the following in their correct column: alligator, anopheles, baronet, bat, blue pansy, chameleon, cobra, cockle, coot, cowrie, crab, crocodile, culex, drongo, earthworm, eel, egret, flying-fox, frog, gecko, giraffe, gourami, hare, helmet, heron, herring, ibis, jacana, jackal, kingfisher, krait, ladybird, leech, lizard, lobster, mackerel, mongoose, monitor, mormon, moth, mussel, night jar, olive, oriole, owl, oyster, painted lady, partridge, plover, pond skater, porcupine, praying mantis, python, quail, rat, robin, salmon, sardine, scallop, scorpion, sea horse, seal, shark, shrimp, siamese fighter, skink, skylark, slug, snail, spider, squirrel, swift, termite, thorny woodcock, toad, tortoise, tree-pie, turtle, viper, vulture, water boatman, wedge, whirligig, woodpecker, yak, zebra.

Annelids	*Molluscs*	*Arthropods*	*Fishes*	*Amphibians*	*Reptiles*	*Birds*	*Mammals*

4. From the animal products listed below, select one or more which are obtained from each of the following and write the number(s) in the corresponding blank space on the left.

________**a.** Cow. ________**b.** Pig.

________**c.** Sheep. ________**d.** Elephant.

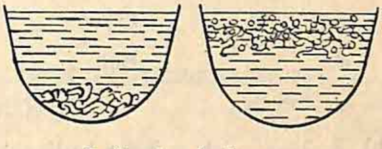
________**e.** Bee. ________**f.** Fox.

Animal products: 1. Ham. 2. Leather shoes. 3. Felt hats. 4. Flannel. 5. Milk. 6. Ivory ornaments. 7. Woollen blankets. 8. Cheese. 9. Glue. 10. Fur coats. 11. Honey. 12. Mutton.

15

The Web of Life

1. A thread-like green plant found floating on a pond is placed in some tap water contained in a glass bowl. When the bowl is kept in a dark cupboard for a few hours the plant is seen lying at the bottom of the bowl. On being taken and placed in the sunlight, however, the plant soon floats close to the surface, and bubbles of gas are seen adhering to the plant.



Left: in darkness
Right: in sunlight

a. Account for the result obtained.

b. How would you proceed to verify your explanation?

c. What information is provided by this experiment as to the value of green plants in maintaining the balance of life in an aquarium?

2. In what ways are plants dependent on:

a. Insects?

b. Birds?

c. Animals in general?

3. State two reasons why animals would soon die if there were no green plants.

i.

ii. ______________________________

____

4. Complete the following food chains.

a. ____________ Slug ____________ Egret.

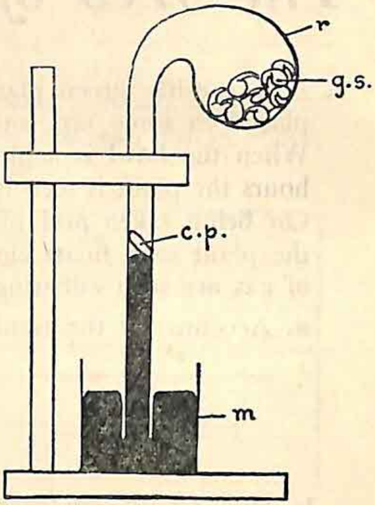
b. Lettuce ____________ ____________ Cat.

c. ____________ Cow ____________ Man.

d. ____________ Bee ____________ Man.

e. Seeds ____________ Egg ____________.

5. A flask with a bent bulb, called a respiroscope, is taken and some germinating seeds are placed in the bulb. The respiroscope is then inverted over a beaker of mercury as shown in the diagram on the right. A stick of caustic potash is taken and with the help of forceps introduced into the respiroscope (caustic potash has the property of absorbing carbon dioxide). After some hours the mercury is observed to have risen in the stem of the respiroscope.



c.p., caustic potash; g.s., germinating seeds; m, mercury; r, respiroscope

a. What is the object of the apparatus?

____

____

b. Why did the mercury rise in the stem of the respiroscope?

____

____

____

c. To what height will the mercury column continue to rise?

____

d. What difference would there be in the result if the stick of caustic potash was omitted from the apparatus?

____

____

e. What difference would there be if fresh green leaves were substituted for the germinating seeds, and the apparatus was placed in the sunlight.

____

____

6. Although carbon dioxide is continuously being produced by respiration, burning and decay, yet the proportion of this gas in the air remains small. Explain.

____

____

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16

Our Food and What Becomes of it

1. Fill in the following table.

My Teeth			
Kinds of teeth	*Special features*	*Function*	*Number*

2. Name:

a. Two digestive enzymes.

i.__________ **ii.**__________

b. The region of the alimentary canal where three different kinds of foods can be digested.

c. The region of the alimentary canal where no digestion takes place.

3. Select the number of the item that best completes the statement, and write it in the blank space on the left of the statement.

______**a.** Since children are growing they have a greater need than adults for (i) vitamins; (ii) water; (iii) proteins; (iv) carbohydrates.

______**b.** The protein-digesting enzyme of the stomach acts only in the presence of (i) water; (ii) saliva; (iii) hydrochloric acid; (iv) bile.

______**c.** Digested food enters the blood stream from the (i) large intestine; (ii) stomach; (iii) gullet; (iv) small intestine.

______**d.** The liver, a gland located near the stomach, (i) helps the stomach to work efficiently; (ii) secretes gastric juice; (iii) governs peristaltic contraction; (iv) produces a digestive juice which helps to digest fats.

______**e.** Both energy and materials for body-building and repair are supplied to our bodies by (i) vitamins; (ii) proteins; (iii) carbohydrates; (iv) mineral salts.

4. Account for each of the following facts.

a. Vegetarians should drink plenty of milk, and non-vegetarians should eat plenty of vegetables.

b. We hold our breath while swallowing.

c. It is important to masticate our food thoroughly before swallowing it.

____

____

5. a. Study the percentage composition of the various foodstuffs given in the table on the right, and then fill in the table on the left.

My Lunch today	
Food items	*Food substances present*

Foodstuff	*Carbohydrate %*	*Fat %*	*Protein%*	*Minerals %*	*Water%*
Milk	5.0	4.0	3.0	0.7	87.0
Butter	—	82.0	1.0	5.0	12.0
Cheese	—	32.0	30.0	3.0	35.0
Lean beef	—	5.0	20.0	3.0	72.0
Fish	—	0.6	22.6	0.8	78.4
Fowl's eggs	—	10.0	15.0	1.0	74.0
White bread	51.0	1.0	7.0	1.0	40.0
Potatoes	18.5	0.5	2.0	0.5	78.5
Rice	77.0	0.5	6.0	0.5	16.0
Wheat	71.2	1.5	11.8	1.5	12.0

b. Prepare coloured bar-graphs below to show the percentage composition of various foodstuffs. The figures given in the table on the right will help you to do this.

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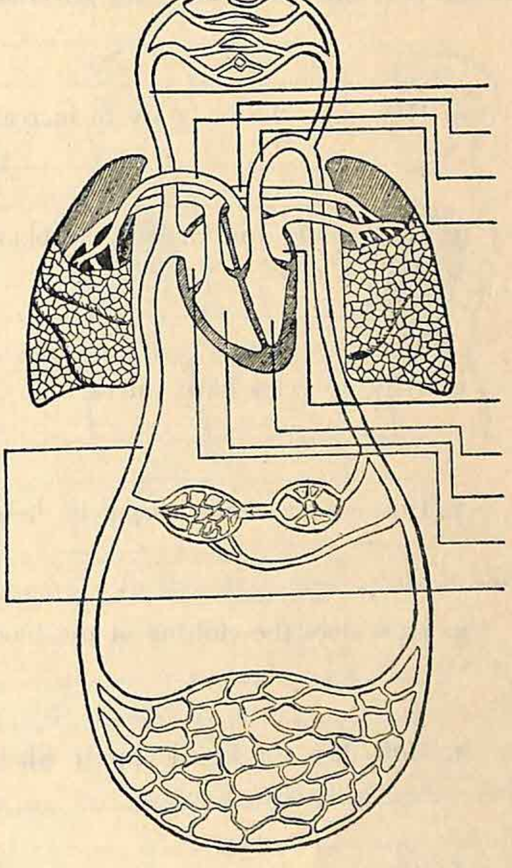
17

Our Amazing Circulatory System



1. The diagram illustrates the course taken by the blood during its circulation around the body.

a. Label the parts indicated by guide lines.

b. Indicate, by unbroken arrows, the path taken by blood during its circulation.

c. Distinguish, by means of shading, oxygenated from de-oxygenated blood.

2. If the statement is true, write the word 'true' in the blank space below the statement; if false, write the word(s) which should be substituted for the italicised word(s) to make the statement true.

a. Most of the plasma consists of *water.*

____

b. The rate of blood flow is highest in the *capillaries.*

____

c. When the heart muscles relax, *blood is forced out of the heart.*

____

d. The work of the *stomach* is to ensure that the blood has the right amount of sugar that the body requires.

____

e. *Arteries* collapse when empty.

____

3. State five uses of the blood.

i. ______________________________

ii. ______________________________

iii. ______________________________

iv. ______________________________

v. ______________________________

4. Answer the following questions.

a. Why are the two sides of the heart separated by a partition?

b. Why are the walls of the left ventricle thicker than the walls of the right auricle?

c. How does the body try to increase the supply of oxygen during exercise?

d. How would you know if the blood flowing from a cut is flowing from an artery or from a vein?

e. Why do veins have valves?

f. How do the white corpuscles help in maintaining the body in good health?

g. How does the clotting of the blood in a wound occur?

h. How does the blood appear when a drop of it is examined under a microscope?

i. Why is a clot of blood red in colour?

j. What is the name of the artery that carries blood which is poor in oxygen?

k. Why is it not possible to feel a pulse in the veins?

l. Why do we loosen the collar of a person who is suffocating?

NAME________________________________ CLASS______________ DATE______________

18

Respiration

1. The two diagrams given below show the positions of the chest cavity and the diaphragm when air is inhaled and exhaled.

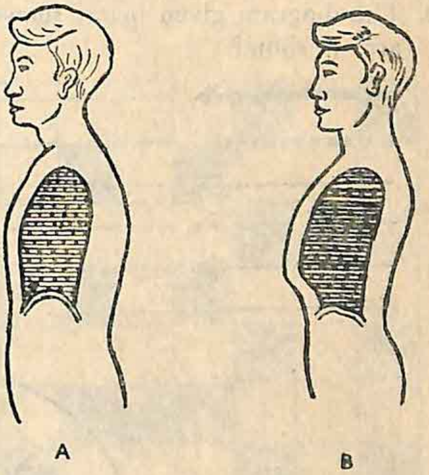
a. Label on each diagram the following: (**i**) diaphragm *D;* (**ii**) chest *C;* (**iii**) abdomen *A;* (**iv**) unbroken arrows to indicate the direction of air entering the body, and broken arrows to indicate the direction of air escaping from the body.

b. Name two structures of the body which control the size of the chest cavity.

i.______________________________

ii.______________________________

c. How does air pressure in the lungs in position *A* compare with the air pressure outside the lungs?______________________________



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d. How does the air pressure in position *B* compare with the air pressure outside the lungs?______________________________

____

e. In which position is the chest (**i**) contracted, (**ii**) expanded? **i.**________ **ii.**________

f. In which position are the muscles (**i**) contracted, (**ii**) relaxed? **i.**________ **ii.**________

g. In which position do the ribs swing (**i**) upwards and outwards, (**ii**) downwards and inwards? **i.**______________ **ii.**______________

2. Answer the following questions.

a. What happens to inspired air in the nose?

____

b. If you run your fingers down your throat you will feel hoops under the skin. What are these, and what is their purpose?

____

____

c. How is the oxidation that takes place in our body similar to that which takes place in a machine, and how does it differ from it?

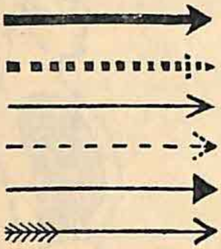
____

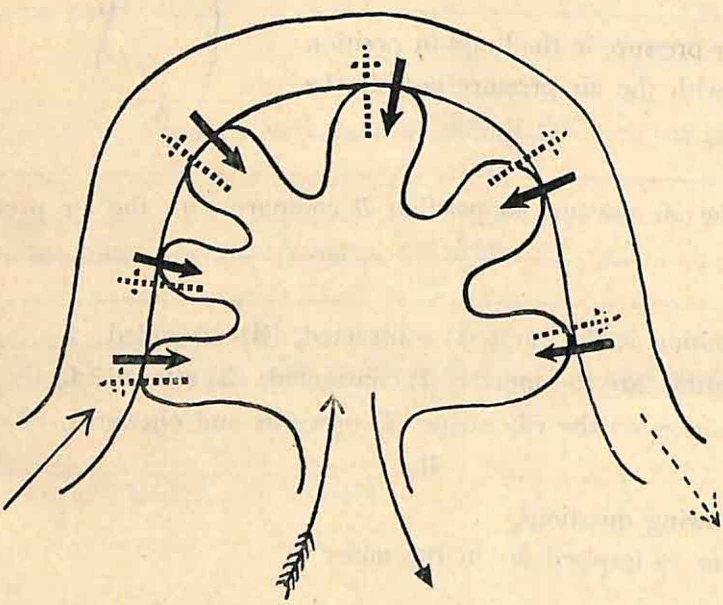
____

d. How would you collect water from your breath?

e. Why does your pulse increase its rate after exercise?

3. The diagram given below shows capillaries around an air-sac. What do the following arrows show?





4. State the relationship between the activity of an animal, and the amount of energy supplied to it by oxidation.

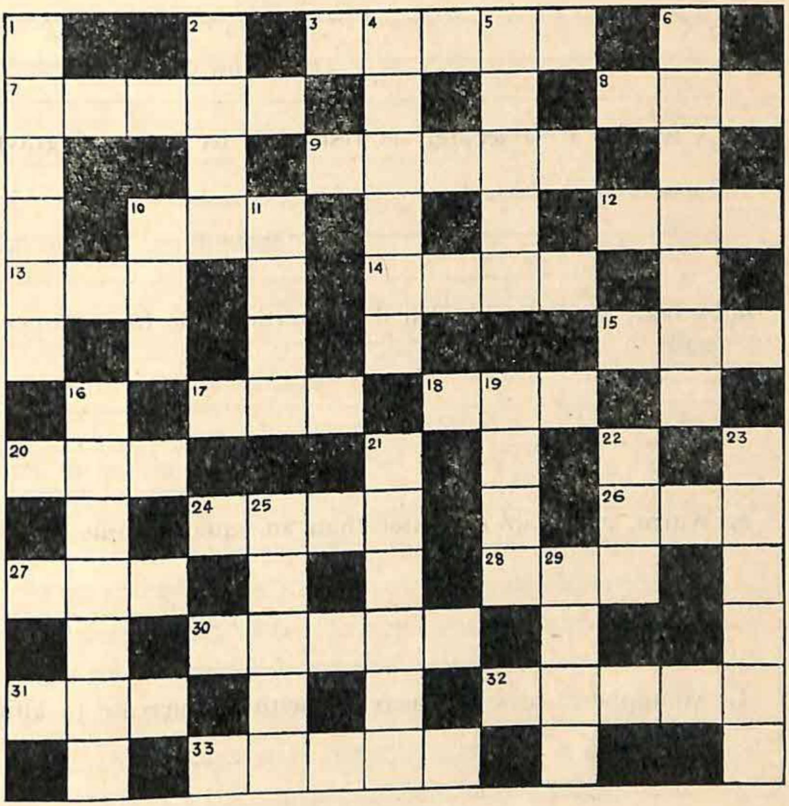
5. Differentiate between exhaled air and inhaled air.

NAME____ CLASS____________ DATE__________________

19

Test Yourself on the Year's Work

1. Do this crossword puzzle.



Clues across

3. Valuable animal product. 7. The artery leaving the left ventricle. 8. A social insect. 9. It carries food to all parts of our body. 10. Female. 12. To sum up. 13. 1·8°F.=____°C. 14. Point of horizon where the sun rises. 15. Indispensable to life. 17. You will see many different kinds of animals here. 18. It requires heat to change it to water. 20. Man finds this the most useful of all mammals. 24. Area of a triangle=$\frac{1}{2}$_______× perpendicular height. 26. The eggs of fish. 27. A kind of deer. 28. Retiring of the tide. 30. Its leaves are edible. 31. A beast of burden. 32. The place where combustion occurs. 33. A group of special cells whose work is to prepare a certain kind of juice.

Clues down

1. One of the constituent elements in carbohydrates. 2. Caused by insects. 4. Found in veins. 5. Descending portion of the axis of a plant. 6. Spirally, coiled structures which are sensitive to contact. 10. Expanse of salt solution that covers most of the earth's surface. 11. Reflection of sound. 16. Soft-bodied animals with hard shells. 19. A solid figure that has six equal square surfaces. 21. Digestive enzyme. 22. Its volume is $\frac{4}{3}\pi r^3$. 23. Unit of thermometric measurement. 25. Nesting time for most birds. 29. A digestive juice.

2. The following is a list of scientific generalisations developed in the text. Beneath each generalisation state a way in which man makes use of this principle in his day to day life.

a. The ratio of circumference to diameter is a constant quantity.

b. Everything on or near the surface of the earth is pulled towards its centre.

c. A body is most securely at rest when its centre of gravity is as low as possible.

d. A body is in equilibrium if the vertical line from its centre of gravity falls within its base.

e. Warm, moist air is lighter than an equal volume of cool, dry air.

f. Atmospheric pressure decreases with an increase in altitude.

g. A liquid absorbs heat during the process of its evaporation.

h. Most substances melt and boil at certain fixed temperatures.

i. Certain substances dissolve in water, while others do not.

j. Different substances have different ignition temperatures.

k. Oxygen is a good supporter of combustion.

l. Carbon dioxide does not support combustion.

3. State:

a. Three uses that water has in our bodies.

i. ____________________

ii. ____________________

iii. ____________________

b. Three physical changes which may occur when heat is added to a body.

i. ____________________

ii. ____________________

iii. ____________________

c. Four effects observed by a man at the top of a mountain.

i. ____________________

ii. ____________________

iii.____

____

iv.____

____

4. Give a reason for the formation of water in each of the following cases.

a. On the outside of a tumbler containing ice water.

____

____

b. At the bottom of a metal pan containing cold water, when it is first held over a flame.

____

____

c. Inside the upper part of a test-tube, when a piece of washing soda is heated, at the bottom of the test-tube.

____

____

5. Describe how you would separate a mixture of two liquids which mix.

*Things required*____

____

*Procedure*____

____

____

____

____

6. Differentiate between the action of mercury in a barometer and the action of mercury in a thermometer.

____

____

____

7. List three methods of increasing heat. Give an example when we employ such a method in everyday life.

i.______________________ *Example:*______________________

____

ii.______________________ *Example:*______________________

____

iii.______________________ *Example:*______________________

____

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